EFFECT OF DIAPHRAGMATIC AND BUTEKYO BREATHING EXERCISE ON FATIGUE, CARDIOPULMONARY ENDURANCE AND QUALITY OF LIFE IN LUNG CANCER

SHORT SYNOPSIS

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DOCTOR OF PHILOSOPHY

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by

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Certificate

I hereby declare that the short synopsis "Effect of Diaphragmatic and Butekyo Breathing Exercise on Fatigue, Cardiopulmonary Endurance and Quality of life in Lung Cancer." being submitted in partial fulfilment of the requirement for the degree of Doctor of Philosophy in Physiotherapy under the faculty of Allied Health Science of Manav Rachna International Institute of Research & Studies, Faridabad during the academic year **2023**. It is a bona fide record of original work carried out under the supervision of Associate prof. (Dr.) Kshitija Bansal and has not been submitted in full or part to any other university or institute for a degree or diploma. Further, it is certified that the short synopsis is plagiarism free, and the proof has been submitted.

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ABSTRACT

Background: Lung cancer (LC) is one of the major causes of mortality in India. Many people are suffering from other complications and indirectly it is affecting their quality of life. Side effects of LC are Fatigue, cardiopulmonary endurance, and quality of life. Breathing exercise helps in relieving complications and improving the quality of life.

Objective: This study is designed firstly, to determine the effect of two breathing exercises namely Diaphragmatic and Buteyko breathing exercises in lung cancer patients on Fatigue, Cardio-pulmonary endurance and quality of life. Secondly, to compare the effectiveness of these breathing exercises.

Method: The study will be an experimental study on 70 subjects with Lung cancer. Subjects will be recruited on the basis of selection criteria and randomly allotted into two groups (n=35). Group A will receive diaphragmatic breathing exercises for four days/ week for 8 weeks and Group B will receive Buteyko breathing exercises for four days/ week for 8 weeks. Subjects will be assessed for fatigue, Cardio-Pulmonary endurance and Quality of Life by Modified Borg Scale, 6 Minute Walk Test and EORTC QLQ-C30 Questionnaire respectively pre as well as post Intervention.

Keywords: Lung cancer, Diaphragm breathing, Buteyko breathing exercise, Fatigue, endurance, quality of life.

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1. Introduction.

1.1 Lung cancer (LC):

LC is one of the most regular diagnosed cancer and major cause of cancer-related deaths globally. The latest updates have shown the seriousness of cancer. It affects not only adults but also children (**Gupta et al., 2016).** In India, it is around 5.9% of all cancers. Lung cancer is associated with breathlessness and coughing. Pathology of LC is complex, with impairments in respiratory functions. These impairments may relate to an effect on respiratory muscle function which have been identified in weakness and fatigue. **Elsevier volume 24 (2021).**

Lung cancer occupied a second mortality rate. There is a decrease in physical activity due to fatigue which directly affects capacity to conduct daily living activities. Cancer treatment methods increase stress, anxiety and fear of life as there are many side effects. During the treatment highly steroids used its effect on immunity system and it makes the patient exercises are more effective in pre and post-rehabilitation periods. (**Hanada et al., 2020).** Moreover the Buteyko breathing techniques and integrated breathing techniques affect stress and improve respiratory functions **Olivier et al.,(2018).**

1.2 Epidemiology, and Impact of Lung Cancer.

Global Lung cancer incidence and mortality, survey according to estimated 2million diagnoses and 1.8million deaths." **Chaitanya Thandra et al., (2021).** Most of Neo-plasmas cases found in urban and industrial area. As a result, LC incidence is rising around the world. Lung carcinoma is based on the cell and area. "According to 2015 WHO, classification of lung cancers are adenoid, Squamous and Neuroendocrine cancer such as small cell ,large cell carcinoma, and characinoid." **Adam barsouk, (2021).**

Over 80% of cases are due to smoke environmental. Cessation of smoking has decreased incidence and mortality. However, continuous usage of tobacco and other factors such as working areas like asbestos stores and inorganic fumes and surrounding exposure to industrial smoke and high molecules of carbon in air remain significant contributors to global countries.

The latest Global Cancer Observation (GLOBOCAN)estimates approximately 2,094,000 new respiratory cancer cases were examined globally wise in 2018.pulmonary cancer is occupied second place in men, prostate cancer is the first place. But the death rate changes this position

Sathish Kumar, Krishnan (2022) study said a "worldwide incidence of 416,500 new cases of cancer in children was found which in turn leading to increased mortality rate in children. It was one of the major causes of death in children aged 5–14 years in Mexico, Brazil, and China in period of 2005 to 2016. (Alastair Fung 2019). In India 2022 estimated cases of cancer was found to be 14, 61,427. The study estimated to increase LC cases by 12.8% in 2025.

1.3 Pathophysiology of Lung Cancer

S.S.Birring, M D Peake. (2005). The study reveals that most of the people who are diagnosed with lung cancer are recognized at the 3rd and 4th stage. The most common symptoms are cough, haemoptysis, dyspnoea, weight loss and weakness. Cough & dyspnoea are most common symptoms. **Hyo Sup Shim, Se Hoon Kim (2010).** pathologists said 5 histological changes were defined as follows Lepidic, Acinar, Papillary, Micropaopillary and solid growth seen in non-mucinous tumours.

Fatigue is the first clinical symptom shown by LC patients, especially in small cell lung cancer, which is referred as Para neoplastic syndrome. Advanced stage cancer patients suffer with distressing cancer related fatigue. Extraordinary creation of certain cytokines. Its may effect metabolism and muscle. Cancer related fatigue main symptoms is mostly observed in 50% of the cancer patients. Losses of body mass and skeletal muscles are characterized but it may not be due to decrease food intake. **Xin Shelley Wang.(2008).**

Tumour refers to “swelling’’ which may produce a mass. It is a area-active inflammatory process and malignant or abnormal growth of tissue**. Chi Yong Ok,(2018).** LC spreads to the lymph nodes meaning it is metastasized to them. Its spread intra Pulmonary ,Mediasternal and extra thoracic lymph nodes. **Lynne Eidride,MD.(2021)**.

LC may narrow bronchiole causing airway restriction causing breathlessness, coughing and chest pain. Later level of Oxygen in blood decreases which in turn puts pressure on heart leading to right ventricular hypertrophy. Morteover, enlarged lungs compresses the superior vena cave. **Robert L Keith.MD, (2022)**

1.4 Effect of Breathing Techniques in Patient with LC.

LC patients are suffering from cough and weakness of muscles. In lung cancer patients, respiratory system functional activity is decreased. These changes will be a focus on gas exchange and blood components as well. The respiratory system and cardiovascular system depend upon each other. The cancer effect in parenchyma alveolar, bronchi as well. The changes in the lungs will be affected by the cardiac cycle. Each cell will need oxygen radicals. The normal percentage of oxygen is decreased, the cell will be destroyed. Oxygen radicals need in every action of the body. During exercise, increases the cardiorespiratory action. The lungs bring oxygen, remove the carbon dioxide, and provide energy. heart pumps oxygenated blood to the muscles while performing exercise.

In exercise, workload on muscles increases, oxygen demand also increases. To cope with this extra oxygen demand, breathing should be increased during exercise. Circulation also increased up to take oxygen consumption. LC patients suffering with dyspnoea and difficulty breathing. Breathing exercise programmes decrease the breathlessness and improving lung endurance. **Cancer. Net.(2021).**

The breathing techniques will improve the ventilation and perfusion ratio. So indirectly, gas exchange will be improved. There are so many articles reveal that diaphragm breathing technique, pursed lip breathing technique, and ACBT active cycle breathing technique. Also, maintain lung functions. The strengthening exercise plays a key role in chest mobility. Diaphragmatic breathing exercises are very important in lung

cancer patients. Diaphragmatic exercise improve the exercise capacity, muscle characteristics and decreased Physical –related fatigue of life in LC survivors. Diaphragm breathing exercise improves the lung compliance. It is a major respiratory muscle to positive correlation with lung volumes .Diaphragm facilitates slow respiration. **Hamasaki.H,(2020).**

1.5 Buteyko Breathing Techniques in Rehabilitation

Konstantin Pavlovich, one of the Russian physicians introduced Buteyko breathing technique in the 1950s. its maintain gases in blood stream. The set of breathing and holding exercise. Inhale the air to nose and holding air some time. This technique is very effective for asthmatics in symptom reduction, enhancement of ability to exercise and improving quality of sleep and life. **Ciobanu LD (2017).** This technique involves breath holding for 5 sec followed shallow breathing for 20-30 sec and again 5 sec break. Total duration of would be 5 min. (Home - Buteyko Breathing Centre UK, 2021).

It is one of the best breathing techniques. This technique improves the control and volume of breathing. This technique helping and prevents respiratory issues such as coughing, wheezing, breathlessness. It's reducing snoring and sleeplessness. This technique improving long functions and exercise tolerance. It reduced mucus production. This technique proves effective in respiratory problems. (Home - Buteyko Breathing Centre UK, 2021). Yoga breathing exercises (pranayama) are also including in the Buteyko breathing technique. Both are involved in mental concentration in causing a controlling of respiratory patterns. This is adapted from Russian technique (Eucapnia Buteyko method) which was first introduced in Australia. Its main focus on ventilation control, but the approach has been designing for western population (Med net-2020).

Literature Review

2.1 lung cancer.

As per American National oncology (ANON,2021), LC is a cancer that forms in the tissues of the lung and also in the cells present in the airway passage with equal mortality rate between both the genders. In this, cells grow uncontrollably. This abnormal growth starts in lung and later metastases to lymphatic system, bronchioles or other remote organs in body. Similarly, the cancer cells can be metastases to lung from some other origin. Further, ANON has reported various risk factors for LC and Smoking was found to be the main predisposing risk factor. But it is impacted by other factors, like passive smoking and exposure to radon and asbestos related smoke. As every smoker does not suffer wit LC, it demonstrates other factors like genetics play a vital role.

2.2 Incidence and Prevalence in lung cancer

Cancer Statistics, 2020 reported that in India cancer suffers in males were 679,421 (94.1 per 1 lac) and in females 712,758 (103.6 per 1lac) during 2020. Further, **Mathur et al., (2020)** reported that One male in 68 males, one female in 29 females, and one in 9 Indians will develop cancer during their lifetime.

Recently, the Indian National Cancer Institute conducted an epidemiological study which reported 229,000 new lung cancer cases in USA in the year of 2020 which accounts for approx. 12% of total cancer cases. US peoples effected cancer in 2020. Moreover, the current incidence of 45.6/lac is much less than the incidence of 69.5/lac in year 1992. The main reason for this dip in numbers is cessation of smoking.

According to **Chaitanya Thandra et al., (2021),** Pulmonary cancer is the leading cause of cancer mortality worldwide. It is more effective in males and females also. In 2018 approximately 1,761,000 deaths were reported due to lung cancer which accounts for 18.4% of total deaths globally. Pulmonary cancer was the major cause of death among men in 93 countries.

In India majority people use of tobacco. in Meghalaya highest rate of cancer patients identified. Among male and female suffering cancer complications. in this area major registered lung carcinoma and oral carcinoma patients. Cancer statistics (2020).Tobacco using person's ratio very high in comparison between north and south-India. In India, there are many challenges in advanced lung cancer treatment polices." **Murali et al.,(2017)**

2.3 Lung Cancer Pathophysiology.

The secondary pathology says the obstructions of the lung and complications about the surrounding areas. The block partially is called focal emphysema. If the obstacle is total is called atelectasis. Sometimes the airway is also affected is called ulcerative/supportive bronchitis, pulmonary abscess. Lung cancer - Symptoms and causes, 2021)

The infection that spread in the pleural cavity is called a pleurisy effusion. In this condition, the pain will be aggressive in the lateral aspect of the chest. Another complication is SVC syndrome. The infection spreads to the midstream, and the pressure is changed, compressing the superior vena cava. So, the circulatory system is compressed the head and neck regions are painful.

In some cases, the tumour will be present in the apical region. It affects surrounding nerves and vasculatures. This condition is called Pan coast tumour. In this condition, around the trachea will be painful and the compression of the cervical sympathetic plexus. Indirectly, the ulnar nerve irritates the whole hand gets pain. In addition, a disrupted nerve pathway on one side from the brain to the face and eye will be affected in some cases. This condition is called Horner's syndrome. (Lung cancer - Symptoms and causes, 2021).

Edwar H.Lambert &Lee M Eaton are American Neurologists. They say in pulmonary cancer, muscle weakness is widespread. Tumour ionic channels felicitate an autoantibody. These elucidate the neuronal calcium channel then affects muscle weakness. This theory is called Lambert-Eaton myasthenic syndrome.Due to paraneoplastic syndrome, elaboration of hormones like factors by lung cancer cells 1 to 10% of patients. ADH- hypothermia, ACTH-Cushing syndrome, peripheral neuropathy, dermatological abnormalities, deep vent thrombosis, and pulmonary embolism are very common. **Gilhus, (2011).**

2.4 Physiotherapy management in lung cancer patients.

Cancer is a multifactorial disease identified by a weakness of muscle mass and changes occur in structurally. **Waning and Guise, (2015)** it cannot recover and functional

fulfil. Day by day functional impairment increased. the chest mobility and lung volumes and capacities also changed. Indirectly the lung compliance decreased. In these patients, changes occur in Inter-Thoracic and Inter-Abdominal pressers. Lot of secretions will be deposited in bronchioles and severe pain will be occur in surrounding area. Breathlessness will be restricted to daily living activity. **Booth, Roberts and Laye, (2012)**.

Cancer treatment modalities indirectly affect the health system and has complications. These things effect of the quality of life. Furthermore, it is also affected by stages of Cancer and other related factors such as cancer related-fatigue, mal nutrition, dyspnoea, haemoptysis, wheeze, and pain which are predominant in Lung cancer. These all symptoms effect not only QOL but also Sleep, psychological and physical activities in most of patients. ANON (2021).

Exercise improve the cardio-vascular functions in LC patients Exercise may also diminish side-effects of chemotherapy or radiation therapy. Andersen**, Vinther, Poulsen and Mellemgaard, (2011).** A simple study shows the pulmonary rehabilitation decreases the risk of post-operative complications and improve the lung function in patients with LC" (Impact of physiotherapy on patients with advanced lung cancer - Sevgi Ozalevli, 2013, 2021).Exercise programs are reducing cancer related weakness in advanced lung disease. this effect directly reduced by breathlessness, and insomnia related fatigue. **Dimeo et al., (2021).**

A best therapeutic exercise program may improve the physically and mentally. Exercise helps with cancer treatments, decreases cancer -related weakness, and reduce the severity of chemo and radiotherapy related effects. Once start physical exercise, breathing, stretching, strength and aerobic program. These are slowly changes your physically active. (The Benefits of Exercise for People With LC, 2021).

2.5 Pulmonary rehabilitation in lung cancer patients.

Antonio Bobbio,et.a.(2019): a prospective study on pre-operative pulmonary rehabilitation in non-small cell lung cancer patients, observational study of physical activity in chronic obstructive pulmonary disease. The program started in 12 patients who are required lung surgery. COPD patients are trained with P.R which lasted for 4weeks. At the

end of the program, there was a great change ie. The intake of oxygen has been increased and was evaluated 15ml/kg/min.

Scarlet da Silva Santos (2018) A disciplined review is being carried on the hospitalised lung cancer patients including children and adults excluding the other patients with other pathological conditions. The studies revealed that the exercise therapy improves the muscle strength, physical fitness.

Amy M Dennett (2016): physical activity effect of lung cancer patients. Moderate-intensity exercise is safe and reduces fatigue and increases the endurance in cancer survivors.

Zahra Mohamed Hassan (2012): the study effect of the Buteyko breathing technique in Bronchial Asthmatic patients. Professor Konstantin Buteyko. He laid the foundation for this application. These is implementing on bronchial asthma patients (N40) between the ages 30 and 50 years and are divided into two groups.one group trained with BBT along with other medications suggested by doctor. Another group did not experience any exercise therapy, received only medicines under the physician. After 6weeks Results showed a positive sign in BBT exercise group. So, the Buteyko Breathing Technique has a vital role in improving the breathing patterns.

Rebekah Mc Clellan(2011) Cancer is a chronic disease which is detected, diagnosed, treatment involves surgery, chemotherapy, radiation. Along with these procedures physiotherapy rehabilitation plays a major part in improving the physical activity and quality of life. 6-minute walk test and hand grip strength include in measuring the improvement of the lung cancer patients.

2.6 Outcome variables of the study.

Xin Liu, MD, Ya-Qing Wang,et.a.(2018) Their study involves the randomized controlled trails performed on 870 patients. The method used is Review Manager and Stata.15. the trail study revealed that breathing exercises and other combined showed positive effect on dyspnoea and 6MWD.

Marcus Jansona, et.a (2019) their study is to investigate whether physiotherapy could improve post-operative conditions. Generally, after the surgery in-hospital physiotherapy is recommended to increase the physical activity level. Single-Blind randomized controlled trail is performed. The physical activity comprised of 6-minute walk test, Actigraph GT3xt

Marcus Jonsson, PhD,et.a. (2019) They studied Postoperative complications after LC surgery. they said hospital physiotherapy after surgery improve the physical activity and lung function. they observation in 107 patients. single blinded randomized controlled trail. They assess the physical activity objectively with accelerometer and subjectively international physical activity questionnaire. total period of study 3 months.

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3. Description of Broad Area.

Cancer rehabilitation is mandatory for cancer patients. After gone through of many articles exercise therapy and breathing exercise is necessary to improve the patient's physical ability and lung functions. LC patients directly depend upon on the caregivers. They suffer physically and mentally because of the uncontrolled cough and breathlessness.

Breathing Exercise and strengthen exercise are helpful in improving the physical ability and mental stability. these techniques indirectly improve the quality of life. Broad area of this study defines the rehabilitation strategies for LC patients using breathing exercises. This is comparative study between Butekyo breathing and diaphragm breathing exercise. It will study effectiveness of Breathing exercises on fatigue, endurance and QOL in lung cancer.

4. Aim of Study.

The aim of the study is to find the effect of Diaphragmatic and Butekyo Breathing Exercise on fatigue, cardiopulmonary endurance, and Quality of Life (QOL) in individuals with lung cancer.

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5. Objectives of Study.

1. To Study the effect of Diaphragmatic Breathing exercise on fatigue, V02max, and QOL in individuals with lung cancer.
2. To Study effect of Butekyo Breathing Exercise on fatigue, V02max, and QOL in Individuals with lung cancer.
3. To compare the effect of Diaphragmatic and Butekyo Breathing Exercise on Fatigue, V02 max, and QOL in individuals with lung cancer.

6. Hypothesis.

Alternate Hypothesis H_1

1. There will be a significant effect of diaphragmatic breathing exercise on fatigue, cardiopulmonary endurance and QOL in individual with lung cancer.
2. There will be a significant effect of Butekyo breathing exercise on fatigue, cardiopulmonary endurance and QOL in individual with lung cancer.
3. There will be a significant difference in effect of diaphragmatic and Butekyo breathing exercise on fatigue, cardiopulmonary endurance, and QOL in individual with lung cancer**.**

Null Hypothesis H_0

1. There will be no significant effect of diaphragmatic breathing exercise on fatigue, cardiopulmonary endurance, and QOL in individual with lung cancer.
2. There will be no significant effect of Butekyo breathing exercise on fatigue, cardiopulmonary endurance, and QOL in individual with lung cancer.
3. There will be no significant difference in effect of diaphragmatic and Butekyoo breathing exercise on fatigue, cardiopulmonary endurance, and QOL in individual with lung cancer.

7. METHODOLOGY

Study design:

Experimental study design (pre-post design)

Study Setting: patients with Lung Cancer will be recruited from city cancer hospital, Vijayawada Mahatma Gandhi Hospital Vishakhapatnam. And other cancer institutes in Vijayawada region.

Sampling Method: Simple random sampling.

Sample size :

The number of patients were determined using G-power software 3.1.9.4 using the data changes in dyspnea score from done by **Pramote Saetan et.al (2019**) in which effect of breathing exercise was evaluated in lung cancer. 35 subjects per group (including10 % dropout) was shown to be necessary based on effect size of 0.874, alpha level 0.05 and power of 0.95. hence the total sample size came out to be 70.

G power software was using to calculate the sample size and following levels Were used:

Un paired "t- study."

Effect size – 0.874

Probability of Error – 0.05

Power (1- β)–0.95

Allocation Ratio–N1/N2 –1

- The total sample size calculated was 70. its subject wise divided into 2 groups

Selection Criteria:

Inclusion Criteria

1. Lung Cancer patients age between 45 to 70 years.

2. 3 rd. stage -ECOG Lung Cancer Guidelines.
3. Lung Cancer patients under chemotherapy and medication.
4. Stable vital signs , walking without support.
5. Both genders.
6. Patient who can read and write English.

Exclusion Criteria

1. Sever respiratory complications. -(COPD, asthma)
2. Metastatic lung cancer.
3. History of other diseases like CAD diabetic.
4. History of any chest deformities. (kyphosis)

Out come performance:

1. Borg's scale. – fatigue
2. 6 min walking test. – cardiopulmonary endurance
3. EORTC QLQ-C13 Questioners scale- quality of life.

Variables

Independent variables

1. Fatigue.
2. VO2 Max
3. Quality of life.

Dependent variables

1. Diaphragmatic breathing exercise.
2. Butkeyo breathing exercise.

Procedure:

The study is experimental pre-post design with two parallel groups and two measurement points: baseline assessment and at the end of eight weeks interventions. The subjects will be

randomly assigned to the experiment and control groups, with a block size of two and an allocation ratio 1:1. using sequentially numbered, sealed and opaque envelopes will ensure the concealment of allocation.

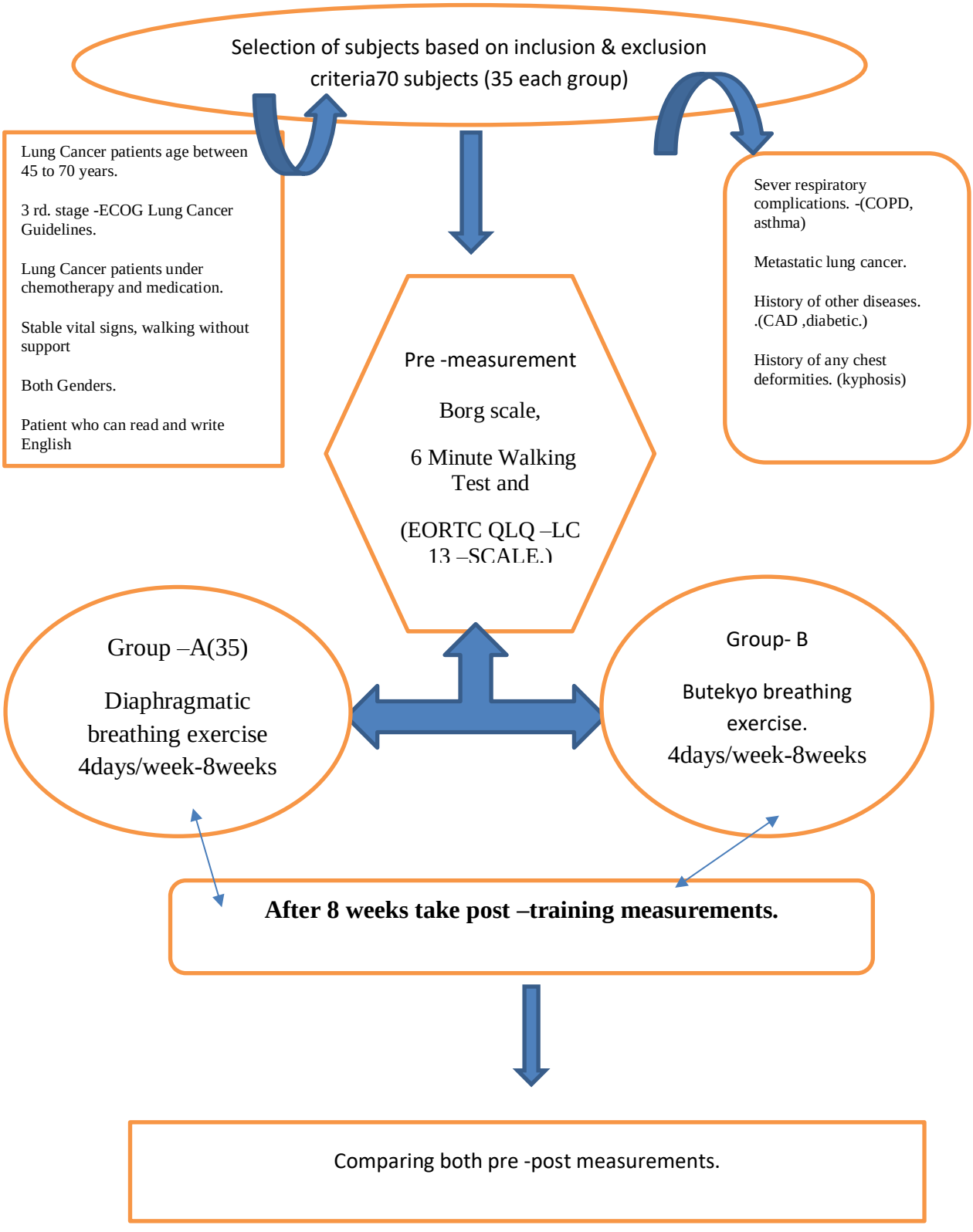
Ethical approval for the same will be applying from the Ethics Committee for Human Research at MRIIRS. After receiving the ethical clearance, lung cancer patients will be screened for the exclusion criteria. Patients who will meet the selection criteria will be recruited in the study. Informed consent will be obtained from the subjects. They will be randomly assigned to Diaphragmatic breathing Group (Group A) & Butekyo breathing Group(group B). The base line measurements for fatigue, Cardiopulmonary endurance and Quality of life will be taken by Borg scale, 6 Minute Walking Test and European Organization for Treatment of Cancer Quality of Life Questionnaires lung cancer scale (EORTC QLQ –LC 13 –SCALE.) respectively.

Group A: The subjects recruited in this group will receive Diaphragmatic exercises. The following procedure will be followed:

Subject will Sit / lie in a relaxed position. one hand will be placed on chest another on abdomen. Subject will be instructed to inhale through his/ her nose for 3-4 seconds and observe abdomen expand. Further he/she will be asked to hold inhaled air for 2-3 seconds and later exhale slowly through mouth for 6 seconds. Repeat for 5-15 minutes. Daily 4 times weekly 5 days.

Group B: The subjects recruited in this group will receive Butekyo breathing exercises. The following procedure will be followed:

Subject will Sit / lie in a relaxed position Small breath in –breath out – holding breath and counting seconds – first signs of an air hunger – normal breathing. It is necessary to learn the technique by face –to –face interaction and then practice 15 -20 minutes, 4 sessions daily for 5 days/ week.


Selection of subjects based on inclusion & exclusion criteria70 subjects (35 each group)
Lung Cancer patients age between 45 to 70 years.
3 rd. stage -ECOG Lung Cancer Guidelines.
Lung Cancer patients under chemotherapy and medication.
Stable vital signs, walking without support
Both Genders.
Patient who can read and write English
Sever respiratory complications. -(COPD, asthma)
Metastatic lung cancer.
History of other diseases. .(CAD ,diabetic.)
History of any chest deformities. (kyphosis)
Pre -measurement
Borg scale,
6 Minute Walking Test and
(EORTC QLQ –LC 13 –SCALE.)
Group –A(35)
Diaphragmatic breathing exercise 4days/week-8weeks
Group- B
Butekyo breathing exercise. 4days/week-8weeks
After 8 weeks take post –training measurements.
Comparing both pre -post measurements.

Procedure for outcome measures:

- ❖ Modified Borg's scale.
- ❖ 6 Min walking test. - vo2 max
- ❖ EORTC QLQ –C 13, questioners scale.

6 min walking test - precautions.

6-minute walking test: American Thoracic Society has developed the test. 6MWT is a maximum physical test is used to assessment of physical performance and endurance. The test conducted 6 min. it used as the outcome by which to compare changes in between pre and post values.

Needs: Stopwatch, 30 meters walkway, 2 cones, pulse-oxy meter for measuring heart rate and SpO_2. The test done under the guidance of Pulmonologist.

Note: CPR kit and oxygen cylinder arranged.

Procedure :

Preparing the subject**.**

Wear loose and comfortable clothes

If support is needed for walking, use walking aids.

Take food 3 hrs prior to test.

Usual medications should be taken.

After the initial rest of 15 mins by subject, baseline BP, RR, heart rate, spo2 and Dyspnoea score will be noted. If the subject needs bronchodilators it will be given 30 min prior to test. The subject will start walking on the marked area for 6 mins. Instructor will be observing the subject for feelings of extreme tiredness and any discomfort or breathlessness to stop immediately.

- vo2 max is the maximum amount of oxygen that can individual can consume during maximal or exhaustive exercise**.**
- **Heart rate ratio method.**
- VO2 max = ml/kg/min.

- VO2 max = 15.3 x (MHR/RHR).

  Where,

  MHR= Maximum Heart Rate. (220- Age)

  RHR = Resting Heart Rate

Formula

- predicated 6MWD = 218+ (5.14×height in cm - 5.32×age in years) - (1.80× weight in kg) + (51.31×gender).

  Gender value: male-1, female -0.

  Formula taken by medicine & science in sports and exercise. (1990)

Modified Borg's scale

This is a scale that asks subject to rate the difficulty of his/ her perceived exertion which in turn will indicate level of fatigue.Borg rating of perceived Exertion is using all type of exercising zones. To measured heart rate, breathing and fatigue. Its depending on physical sensation in during exercise. Modified Borgs scale with its 0-10 numbering to easier calculation and estimated. **Elizabeth Quinn, MS. (2021)**

'0 is represented by no activity its indicate rest 10 maximum activity its indicate maximum physical endurance**. (Refer Annexure I)**

Quality of life

EORTC QLQ –LC 13 –SCALE. European Organization for Treatment of Cancer Quality of Life Questionnaires lung cancer scale. It will be used to analysis of patient life styles and changes.

This scale has 10- point thresholds for identifying within patients changes on European Organisation for Research and treatment of cancer scores in LC. Each score, proposed for interpretation changes in LC range 11.11 to 33.33.the scale used in oncology trails to measure the effect of therapy, functioning and symptoms. QLQ –LC-13 Developed for NSCLC to evaluate changes in scores for individuals over the therapy**. Cheryl D. Con,.(2022)**

The Questions depending on Cough, Breath, Walk, Pain and Physical capacity.

Questionnaire table taken by http://qol.eortc.org. (Refer Annexure II)

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Appendix.

Refer Annexure I

Rated perceived exertion scale.

This scale is used to measure the intensity of exercise. It’s find out physical functional activity.

score	
0	No activity (Rest)
1	Very light activity (Gentle stretching)
2	
3	Light activity (slowly walking)
4	
5	Moderate activity (brisk walking)
6	
7	Vigorous activity (jogging)
8	
9	Very hard activity (running)
10	Maximum activity (shuttle run drills)

Refer Annexure II

EORTC QLQ-LC13

During the past week

s.no	Question.	Not at all	A Little	Quite.a Bit	Very Much
1	How much did you cough?	1	2	3	4
2	Did you cough up blood?	1	2	3	4
3	Were you short of breath when you rested?	1	2	3	4
4	Were you short of breath when you walked?	1	2	3	4
5	Were you short of breath when you climbed stairs?	1	2	3	4
6	Have you had a sore mouth or tongue?	1	2	3	4
7	Have you had trouble swallowing/	1	2	3	4
8	Have you had tingling hands or feet?	1	2	3	4
9	Have you had hair loss?	1	2	3	4
10	Have you had pain in your arm or shoulder?	1	2	3	4
11	Have you had pain in other parts of your body?	1	2	3	4
12	Have you had pain in other parts of your body? If yes, where	1	2	3	4
13	Did you take any medicine for pain? 1 NO 2 YES If yes, how much did it help?	1	2	3	4

this table taken by http://qol.eortc.org.

Refer Annexure III

Ecog performance status scale.

GRADE	ECOG PERFORMANCE STATUS
0	Fully active, able to carry on all pre-disease performance without restriction
1	Restricted in physically strenuous activity but ambulatory and able to carry out work of a light or sedentary nature, eg: light house work, office work.
2	Ambulatory and capable of all self care but unable to carry out any work activities; up and about more than 50% of waking hours
3	Capable of only limited self-care; confined to bed or chair more than 50% of waking hours
4	Completely disabled; cannot carry on any self care; totally confined to bed or chair
5	Dead

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